

NASA ADVISORY COUNCIL  
National Aeronautics and Space Administration  
Washington, DC 20546  
Hon. Harrison H. Schmitt, Chairman

July 11, 2006

The Honorable Michael D. Griffin  
Administrator  
National Aeronautics and Space Administration  
Washington, DC 20546

Dear Dr. Griffin:

Thank you for the feedback that the Council has been receiving from you and your staff regarding the status of NASA action on the recommendations that were delivered on April 3, 2006. The Council Committees have been briefed on the responses at recent fact-finding meetings, and Council members and the public received a brief update at the meeting at the Jet Propulsion Laboratory (JPL) on May 18.

During that meeting at JPL, very useful fact-finding and plenary sessions were held and each of the Council Committees developed additional recommendations and findings. These were deliberated by the entire Council in a public meeting and approved for transmittal to NASA. A short description of each of these recommendations and findings is included below and further background for each is enclosed. These are being sent to you on behalf of the entire Council, but for ease of reference they are arranged below by the committee from which they originated.

**Aeronautics**

- 1) The NASA Advisory Council strongly endorses the Administrator's goal of increasing the agency's in-house capability to design, develop, test, and carry out essential engineering activities. **(A-06-F1)**

**Human Capital**

- 2) Seek statutory authority to deal with the problem of the current uncovered workforce. NASA should look to the Air Force as a possible model of an agency that obtained more hiring flexibility. Target the "best and brightest" college graduates and practicing scientists and engineers to address near-term (<2010) problems. Aggressively pursue the "best and brightest" K-16 students (the upper 5% in math and science) for NASA and NASA-related industries to have a major effect on the post-2010 workforce. **(HC-06-1)**
- 3) Increase collaborations with other federal agencies and industrial and academic partners to align with federal programs, in particular, the President's Competitiveness Initiative. **(HC-06-2)**
- 4) Hold the Office of Human Capital Management accountable for reexamining the present federal policy (E.O. 11935) for employment of foreign nationals with the objective of increasing hiring flexibility relative to this pool of talent and experience. **(HC-06-3)**

- 5) Consolidate all of the educational outreach programs and resources within one directorate. **(HC-06-4)**
- 6) Establish programs specifically targeted to the most academically talented math and science students. **(HC-06-5)**

### **Exploration**

- 7) In order to foster mission success and crew safety for long-duration exploration missions, and to maximize the likelihood that critical development milestones can be met, it is recommended that NASA:
  - a. Complete an integrated strategic plan that provides a timely and orderly approach to addressing the basic and applied biomedical research that flows temporally and conceptually from NASA's Constellation Program. Such a plan should address timelines that are consistent with the planned development milestones for Lunar exploration and habitation and for Martian exploration, and should include necessary funding sources and amounts. **(E-06-2.1)**
  - b. Construct and implement a plan for mining the existent biomedical data on humans in space, including enhancing access to those data for the broader, qualified biomedical research community. **(E-06-2.2)**
  - c. Foster relationships with governmental agencies (e.g., NIH, FDA, NSF, DOD, etc.), industries, universities and individual investigators that offer opportunities to fill the gaps in the basic biomedical research that will be required to support the Exploration Vision. **(E-06-2.3)**

### **Science**

- 8) The Council Science Committee supports the recommendations of its subcommittees to consider FY07 funding re-allocations for Research and Analysis (R&A) once the FY07 Budget has passed the Congress and been signed into law. Formulation of the FY08 Budget should place funding for R&A at the highest feasible priority level within the overall budgetary constraints imposed by the Administration. The Astrobiology Program should be treated in the same way as any other R&A program. (See Recommendation S-06-7 on Astrobiology.) Any reallocations should not come at the expense of small flight missions, which, together with R&A, support the pipeline of human capital and technology. **(S-06-4)**
- 9) Develop the Science Plan draft using the following guidelines:
  - a. Define key scientific questions for each area;
  - b. Define reasonable progress in each area by 2016;
  - c. Describe the roles of major project elements (R&A, technology, large and small missions, etc) in each area. It is understood that the means will differ from question to question;
  - d. Use OMB budget guidelines as the financial envelop to:
    - i. Define missions and specific programs;
    - ii. Define S&T investments that need to be made now to enable a robust set of program/mission options in 2011;
  - e. Use this planning exercise to inform FY08 budget formulation. **(S-06-5)**

10) Manage cost and risk in mission classes via the following:

- a. Undertake a study of cost drivers of large missions, especially with regard to process and procedures and how much cost they contribute. **(S-06-6.1)**
- b. Assess the stability of the program in terms of an optimal portfolio of flagship, medium, and small missions. **(S-06-6.2)**
- c. Define different levels of processes and procedures for small, medium and large mission classes, with presumption that science community can accept higher risk for smaller missions. **(S-06-6.3)**

11) Treat NASA's Astrobiology program the same way as any other R&A program. **(S-06-7)**

Best Regards,

A handwritten signature in cursive script, reading "Harrison H. Schmitt".

Harrison H. Schmitt  
Chairman

Enclosures (12)

NASA Advisory Council  
Committee Finding  
**Tracking Number: A-06-F1**

Committee Name: Aeronautics Committee

Chair: Mr. Neil Armstrong

Date of Public Deliberation: May 18, 2006

Date of Transmission: July 11, 2006

Short Title of Finding

The NASA Advisory Council strongly endorses the Administrator's goal of increasing the agency's in-house capability to design, develop, test, and carry out essential engineering activities.

Background to Finding

In as much as a substantial fraction of the NASA effort is associated with contracting industry, the agency must itself be an informed buyer. This in turn implies that NASA have an organic staff of engineers who can complete a substantial fraction of pre-proposal engineering and development, and are, therefore, able to evaluate and manage the industry proposals as peers of the company engineers. Such a workforce must have a wide distribution of experience and age to ensure a corporate memory. NASA must also provide opportunities for the younger engineers to gain experience by exercising their own skills, and by being mentored by more experience engineers

Further, the concept of an agency complete with informed buyers with a broad range of skills extends beyond engineers, though it may be the most critical in engineering skills.

Failure to have such a body of skilled engineers is likely to result in lower quality Requests for Proposals, as well as an increased likelihood of accepting programs with inadequate technical content leading to cost and schedule over-runs or systems that are less prepared to execute the mission.

NASA Advisory Council  
Committee Recommendations  
**Tracking Number: HC-06-1**

Committee Name: Human Capital Committee

Chair: Dr. Gerald Kulcinski

Date of Public Deliberation: May 18, 2006

Date of Transmission: July 11, 2006

Short title of the Recommendation

Workforce flexibility and uncovered capacity

Short description of this Recommendation

Seek statutory authority to deal with the problem of the current uncovered workforce. NASA should look to the Air Force as a possible model of an agency that obtained more hiring flexibility. Target the “best and brightest” college graduates and practicing scientists and engineers to address near-term (<2010) problems. Aggressively pursue the “best and brightest” K-16 students (the upper 5% in math and science) for NASA and NASA-related industries to have a major effect on the post-2010 workforce.

Major reasons for proposing the Recommendation

There is a short term problem in hiring because of the uncovered employees in NASA Centers.

On the other hand, NASA demographics indicate that there will be a large fraction of employees eligible to retire in the near term.

In addition, new skills will be required to achieve the Vision for Space Exploration and there is a current shortage of U. S. graduates in key NASA disciplines.

Consequences of no action on the Recommendation

The U.S. will lose science and technology leadership and may not be able to complete critical space missions. This will have strategic implications for the U.S.

NASA Advisory Council  
Committee Recommendations  
**Tracking Number: HC-06-2**

Committee Name: Human Capital Committee

Chair: Dr. Gerald Kulcinski

Date of Public Deliberation: May 18, 2006

Date of Transmission: July 11, 2006

Short title of the Recommendation

Attraction of highly qualified scientists and engineers for NASA's space exploration programs.

Short description of this Recommendation

Increase collaborations with other federal agencies and industrial and academic partners to align with federal programs, in particular, the President's Competitiveness Initiative.

Major reasons for proposing the Recommendation

This should help to address the necessary expansion of the pool of exceptional students in math, science, and engineering. NASA is in danger of losing many talented graduates to other fields of science and engineering. On the other hand, NASA will need talented scientists and engineers from other federal agencies to complete its exploration mission.

The U.S. needs to continue its international leadership in innovation and avoid losing talent to other nations.

Consequences of no action on the Recommendation

NASA alone may not have the necessary resources nor the personnel to complete future complex human exploration missions and will not be an informed buyer.

NASA Advisory Council  
Committee Recommendations  
**Tracking Number: HC-06-3**

Committee Name: Human Capital Committee

Chair: Dr. Gerald Kulcinski

Date of Public Deliberation: May 18, 2006

Date of Transmission: July 11, 2006

Short title of the Recommendation

Streamline procedures for hiring foreign nationals.

Short description of this Recommendation

Hold the Office of Human Capital Management accountable for reexamining the present federal policy (E.O. 11935) for employment of foreign nationals with the objective of increasing hiring flexibility relative to this pool of talent and experience.

Major reasons for proposing the Recommendation

Roughly half of advanced degree science and engineering graduates in the U.S. are awarded to foreign nationals.

At the present time, of  $\approx 18,000$  NASA employees there are 8 non-U.S. employees. Currently the Space Act of 1958 allows NASA to hire up to 150 foreign nationals.

Recognizing that NASA does not dictate national immigration policy, it is nonetheless important to revisit the present policy of underutilization of non-U.S. scientists and engineers working at NASA Centers.

Consequences of no action on the Recommendation

The U.S. would not be taking advantage of at least half of the current labor pool of science and engineering graduates.

There will be one less avenue for ameliorating current workforce shortages.

NASA Advisory Council  
Committee Recommendations  
**Tracking Number: HC-06-4**

Committee Name: Human Capital Committee

Chair: Dr. Gerald Kulcinski

Date of Public Deliberation: May 18, 2006

Date of Transmission: July 11, 2006

Short title of the Recommendation

Consolidation of education resources and programs.

Short description of this Recommendation

Consolidate all of the educational outreach programs and resources within one directorate.

Major reasons for proposing the Recommendation

Approximately half of the education outreach budget (total ≈\$300M) is outside the control of the NASA Office of Education. This type of organizational structure causes redundancy, duplication of effort, loss of efficiency, and lack of focus.

Consequences of no action on the Recommendation

There will be less efficient use of scarce resources within NASA.



NASA Advisory Council  
Committee Recommendations  
**Tracking Number: HC-06-5**

Committee Name: Human Capital Committee

Chair: Dr. Gerald Kulcinski

Date of Public Deliberation: May 18, 2006

Date of Transmission: July 11, 2006

Short title of the Recommendation

Establishment of programs for academically talented math and science students

Short description of this Recommendation

Establish programs specifically targeted to the most academically talented math and science students.

Major reasons for proposing the Recommendation

In an increasingly competitive world, there is a need to maximize the potential of all students, including the highest achievers, who have the potential to tackle the most difficult scientific and engineering problems facing NASA and the nation.

This cohort is very often ignored in the belief that they need no encouragement to pursue NASA-related careers.

Example of the complexity of this issue – The decision to cut the Astrobiology program in FY07 by 50% from its FY05 level will directly affect NASA's ability to attract top academic students and retain 100's of top graduates in this area. There are currently no NASA K-12 programs specifically targeting the most academically talented students (upper 5% in math and science).

This nation needs to maximize the potential of top college graduates to insure our future competitiveness.

Consequences of no action on the Recommendation

NASA, as well as other private and public sectors, will not have a sufficiently large pool of highly talented graduates to compete in the global science and technology arena.

NASA Advisory Council  
Committee Recommendations  
**Tracking Number: E-06-2**

Committee Name: Exploration Committee (and *ad hoc* Biomedical Committee)

Chair: Gen. James Abrahamson

Date of Public Deliberation: May 18, 2006

Date of Transmission: July 11, 2006

Short title of the Recommendation

Allocate necessary resources for timely conduct of biomedical research required to support the Vision for Space Exploration.

Short description of this Recommendation

In order to foster mission success and crew safety for long-duration exploration missions, and to maximize the likelihood that critical development milestones can be met, it is recommended that NASA:

1. Complete an integrated strategic plan that provides a timely and orderly approach to addressing the basic and applied biomedical research that flows temporally and conceptually from NASA's Constellation Program. Such a plan should address timelines that are consistent with the planned development milestones for Lunar exploration and habitation and for Martian exploration, and should include necessary funding sources and amounts. **(E-06-2.1)**
2. Construct and implement a plan for mining the existent biomedical data on humans in space, including enhancing access to those data for the broader, qualified biomedical research community; **(E-06-2.2)** and
3. Foster relationships with governmental agencies (e.g., NIH, FDA, NSF, DOD, etc.), industries, universities and individual investigators that offer opportunities to fill the gaps in the basic biomedical research that will be required to support the Exploration Vision. **(E-06-2.3)**

Major reasons for proposing the Recommendation

1. Extended mission duration and remoteness from Earth-based support expose both crew and systems to hazards and potential risks that are far greater than those experienced in low Earth orbit. Current biomedical knowledge is limited, and in some areas, inadequate, to address these risks.
2. Current funding for biomedical research has been curtailed significantly (to approximately one-third of that in the FY2005 NASA budget) and concentrated almost exclusively on applied research (CRL and TRL levels of four or greater).
3. Two-thirds of the deliverables in the Bioastronautics Roadmap are either undefined or below this threshold, leaving them as "orphans" without direction or funding. Many of these research gaps are critical for the success of the Exploration Vision, especially for the human missions to and on Mars and for long duration lunar activities. These deliverables are at such nascent levels that it will almost certainly require many years

of combined basic and applied research to address them appropriately, even by efficient and appropriately funded investigators and laboratories.

4. NASA will need to rely primarily on its own resources to obtain the needed biomedical knowledge, although other agencies and organizations clearly can augment and enhance this research in selected areas where interests in related terrestrial issues coincide.
5. Some projects involve areas of research that are of great interest to the wider biomedical research community, and that have application to public health for all Americans and others throughout the world. In this context, NASA offers unique resources in facilities, technology and expertise that complement the needs of the biomedical research community that has not have participated in NASA-related research previously. Not the least of these research facilities is the International Space Station. Collaborations with other institutions with coincident interests might lessen the demands on NASA resources and will bring new expertise to the effort that enlightens and accelerates research in selected areas.

#### Consequences of no action on the Recommendation

1. Closing the gaps between currently funded research and the research needed to inform and support the Exploration Vision will be critical for the short-term development of a flexible Exploration Architecture and for the design of the proposed Lunar missions, and essential for the long-term plans for the exploration of Mars and beyond. Unless additional, well-planned, well-executed biomedical research is undertaken, the development of standards and requirements for the new crew exploration vehicle will be delayed or inadequately informed, thus increasing the likelihood that subsequent design modifications, with their associated costs, will be required.
2. The key biomedical research that is required to support the Exploration Vision, especially that which is needed for extended duration missions such as longer stays on the Moon or the Mars mission, will be delayed or these missions will proceed with added risk to mission success and crew health and safety.

NASA Advisory Council  
Committee Recommendation  
**Tracking Number: S-06-4**

Committee Name: Science Committee

Chair: Dr. Charles Kennel

Date of Public Deliberation: May 18, 2006

Date of Transmission: July 11, 2006

Short title of the Recommendation

Budget Allocations for Research and Analysis Program including Astrobiology

Short description of this Recommendation

The Council Science Committee supports the recommendations of its subcommittees to consider FY07 funding re-allocations for Research and Analysis (R&A) once the FY07 Budget has passed the Congress and been signed into law. Formulation of the FY08 Budget should place funding for R&A at the highest feasible priority level within the overall budgetary constraints imposed by the Administration. The Astrobiology Program should be treated in the same way as any other R&A program. (See Recommendation S-06-7 on Astrobiology.) Any reallocations should not come at the expense of small flight missions, which, together with R&A, support the pipeline of human capital and technology.

Major reasons for proposing the Recommendation

Based on letters and recommendations from the Science Subcommittees to the Science Committee following their recent Conference at the University of Maryland, the Council believes that NASA's response to the policy constraints imposed on it in the FY06 and FY07 budgets, though necessary, unduly affected the R&A allocation within SMD. There is a common view, however, among the Space Studies Board and the Council, its Science Committee, and its Science Subcommittees, that insufficient total funding was budgeted to NASA for the agency to meet all of the diverse objectives that it had been directed to pursue. Attached also is a summary list of common recommendations from the Science Subcommittees following their conference at College Park, Maryland on May 3-4, 2006. This summary was compiled by the Science Committee based on letters received from the Subcommittees.

Consequences of no action on the Recommendation

Advanced planning for future missions will be adversely affected, as will operational effectiveness and science return from current missions. Also, failure to act positively on this recommendation will result in significant reductions in the numbers of graduate students and potentially in the levels of activity of other researchers working on future space related projects. This in turn will negatively impact the cadre of skilled personnel available to implement future space related activities.

NASA Advisory Council  
Committee Recommendations  
**Tracking Number: S-06-5**

Committee Name: Science

Chair: Dr. Charles F. Kennel

Date of Public Deliberation: May 18, 2006

Date of Transmission: July 11, 2006

Short title of the proposed Recommendation

Science Plan input to initial draft

Short description of the proposed Recommendation

Develop the Science Plan draft using the following guidelines:

- Define key scientific questions for each area
- Define reasonable progress in each area by 2016
- Describe the roles of major project elements (R&A, technology, large and small missions, etc) in each area. It is understood that the means will differ from question to question
- Use OMB budget guidelines as the financial envelop to:
  - Define missions and specific programs
  - Define S&T investments that need to be made now to enable a robust set of program/mission options in 2011
- Use this planning exercise to inform FY08 budget formulation

Major reasons for proposing the Recommendation

The outline and basic form of this plan is sound. The SMD Science Plan will be an important document in defining how limited resources will be effectively employed in the near-term to both accomplish near-term objectives and to prepare for the future. The plan must be robust enough to guide choices and activities should new opportunities arise.

Consequences of no action on the proposed Recommendation

Without this approach, the Plan would be driven by current programmatic and budgetary circumstances rather than by the science that can and should be done.

NASA Advisory Council  
Committee Recommendations  
**Tracking Number: S-06-6**

Committee Name: Science

Chair: Dr. Charles F. Kennel

Date of Public Deliberation: May 18, 2006

Date of Transmission: July 11, 2006

Short title of the Recommendation

Managing cost and risk in mission classes

Short description of the Recommendation

NASA's SMD should:

- Undertake a study of cost drivers of large missions, especially with regard to process and procedures and how much cost they contribute. (S-06-6.1)
- Assess the stability of the program in terms of an optimal portfolio of flagship, medium, and small missions.(S-06-6.2)
- Define different levels of processes and procedures for small, medium and large mission classes, with presumption that science community can accept higher risk for smaller missions. (S-06-6.3)

Major reasons for proposing the Recommendation

The combined cost of two flagship missions threatens the stability of the Astrophysics program; therefore cost vigilance in those two programs in particular is essential.

Consequences of no action on the proposed Recommendation

Large mission cost growth will continue to squeeze out opportunities for smaller missions.

NASA Advisory Council  
Committee Recommendations  
**Tracking Number: S-06-7**

Committee Name: Science

Chair: Dr. Charles F. Kennel

Date of Public Deliberation: May 18, 2006

Date of Transmission: July 11, 2006

Short title of the Recommendation

Astrobiology budget planning

Short description of the Recommendation

Treat NASA's Astrobiology program the same way as any other R&A program.

Major reasons for proposing the Recommendation

The Astrobiology program should have been treated like any other R&A Program. These scientific investigations support NASA's strategic goals. In addition, this program is particularly attractive to the broader science community and the general public.

In the FY07 budget request, funding for Astrobiology was reduced 50%, while the rest of R&A was reduced 15%. Astrobiology is a young discipline created by NASA. It is the principal means by which leading researchers in biology come to be engaged in NASA programs, and also an integrating theme in the SMD portfolio.

Consequences of no action on the proposed Recommendation

Prominent biologists and new astrobiology investigators will turn their professional attentions away from NASA programs and science questions, reducing NASA's capability to address scientific questions about life in the universe.

**Common Recommendations from the  
NASA Advisory Council Science Subcommittees  
Addendum to Recommendations S-06-4 to S-06-7**

Discussed at Science Subcommittee Meeting  
May 3-4, 2006, College Park, MD

Presented to the NASA Advisory Council  
May 18, 2006, Pasadena, CA

NRC Report:

- The NAC Science Subcommittees universally endorse the recommendations of the NRC Report “An Assessment of Balance in NASA’s Science Programs” released May 4, 2006.

R&A:

- Restoration of R&A, at least in part, including Mission Data Analysis, and its maintenance over the years is a high priority. Heliophysics indicated the least need for restoration, and perhaps Planetary indicated the most need for restoration. Cuts to Astrobiology are particularly damaging and should receive immediate attention. Without scientists, there are no science missions. R&A supports the community that conceives missions, works with engineers to develop and operate missions, and produces discoveries from mission data.

Technology Development:

- Near-term investment in technology development is critical to the future of science missions. Sufficient resources should be invested in concept studies and in Phase A technology development in each science division for the future missions in their Decadal plans.

Mission Balance:

- Effective scientific exploration of space requires both large and small missions. There should be a balance of large, medium, and small missions specific in each science division over the decadal time scale.
- Opportunities for small, community-led missions need to be preserved. The Explorer line has been particularly hard hit and needs restoration.

Stability:

- The stability of the science program needs to be restored in order to properly plan for the future. Erosion of research and technology programs, mission cancellations, and mission delays must be avoided. Scientifically productive missions currently in operation should be extended.

Mission Cost:

- Costs for missions in development have been escalating to alarming levels. NASA should investigate and mitigate this problem. Large percentage increases, particularly for flagship missions, raise havoc with maintaining balance in the program.